I CLAIM:

1. A communications signal embodied in a transmission medium and for use in a communications network, comprising:

recurrent wrapper bursts, each wrapper burst comprising one or more wrapper symbols, each of which corresponds to an information bit;

wherein each wrapper symbol is characterized by a signal level transition pattern, said signal level transition pattern being either a first pattern or a second pattern depending on the logic value of the respective information bit; and

wherein the first and second patterns each have a distinct average signal level and are each characterized by at least one signal level transition.

2. A signal as claimed in claim 1, wherein the first and second patterns each have a plurality of signal level transitions which are sufficiently densely spaced in time to enable far-end receiver synchronization.

3. A signal as claimed in claim 1, wherein the first and second patterns are complementary.

4. A signal as claimed in claim 1, wherein the first and second patterns each have at least one rising edge and at least one falling edge.

5. A signal as claimed in claim 1, wherein the first pattern has multiple substantially evenly distributed pulses.

6. A signal as claimed in claim 5, wherein the second pattern has multiple substantially evenly distributed recesses.

7. A signal as claimed in claim 1, further comprising a payload segment between each adjacent pair of wrapper bursts, wherein each wrapper burst has a duration substantially less than the duration of either adjacent payload segment.

8. The signal of claim 1 being an optical signal.

9. The signal of claim 1 being an electrical signal.

10. A communications signal embodied in a transmission medium, comprising:

alternating payload and wrapper segments;

wherein each wrapper segment comprises a contiguity of signal level sequences;

wherein each signal level sequence is characterized by an average signal level indicative of the binary value of a bit of an information bit stream; and

wherein each signal level sequence comprises at least one intermediate signal level transition.

11. A signal as claimed in claim 10, wherein the payload and wrapper segments are binary-valued.

12. A signal as claimed in claim 10, wherein each signal level sequence is either a first pattern or a second pattern, depending on the binary value of the respective bit of the information bit stream.

13. A signal as claimed in claim 12, wherein the first and second patterns are complementary.

14. A signal as claimed in claim 12, wherein each of the first and second patterns has at least one rising edge and at least one falling edge.

15. A signal as claimed in claim 12, wherein the first pattern has multiple substantially evenly distributed pulses.

16. A signal as claimed in claim 15, wherein the second pattern has multiple substantially evenly distributed recesses.

17. A signal as claimed in claim 10, wherein each wrapper segment has a duration substantially less than the duration of any adjacent payload segment.

18. The signal of claim 10 being an optical signal.

19. The signal of claim 10 being an electrical signal.

20. A communications signal embodied in a transmission medium, comprising:

alternating payload and wrapper segments, each wrapper segment consisting of a concatenation of binary signal level patterns;

wherein each binary signal level pattern is associated with a bit of an information bit stream;

wherein each binary signal level pattern is either a first pattern or a second pattern, the first and second patterns being associated with respective ones of two possible logic values for a bit in the information bit stream;

wherein the first pattern consists mostly of a low signal level and partly of a high signal level; and

wherein the second pattern consists mostly of the high signal level and partly of the low signal level.

21. A communications signal embodied in a transmission medium, comprising:

alternating payload and wrapper segments, each wrapper segment comprising a concatenation of pulse groups, each pulse group encoding a bit of an information bit stream;

wherein the pulse sequence which encodes one of two possible logic values for a bit in the overhead bit stream consists of at least one pulse and has a pulse density of strictly less than 50 per cent; and

wherein the pulse sequence which encodes the other possible logic value for a bit in the information bit stream consists of not all pulses and has a pulse density of strictly more than 50 per cent.

22. A method of extracting an overhead bit stream from a composite optical signal consisting of segments of a high-speed data stream alternating with segments of a digital wrapper, each digital wrapper segment containing a plurality of wrapper symbols each of which has an average signal level indicative of the logical value of a bit in the overhead bit stream, the method comprising the steps of:

converting the composite optical signal into an electrical signal having an electrical bandwidth that is substantially less than the bandwidth of the high-speed data stream;

locating the position of each wrapper segment in the low-bandwidth electrical signal; and

detecting individual bits of the overhead bit stream from the average level of the low-bandwidth electrical signal during the located wrapper segments.

23. A method as claimed in claim 22, further comprising:
buffering the bits of the overhead bit stream following detection thereof and outputting said bits periodically at the bit rate of the overhead bit stream.

24. A method as claimed in claim 22, further comprising:
verifying the integrity of a connection map being applied by a switch as a function of the bits in the overhead bit stream.

25. A method as claimed in claim 22, wherein the step of detecting comprises:
for each wrapper symbol interval in each located wrapper segment, measuring an average signal level of the low-bandwidth electrical signal during that wrapper symbol interval;
comparing the measured average signal level to a threshold; and
if the measured average signal level is above the threshold, concluding that the corresponding bit in the overhead bit stream is a logic "one" and if the measured average signal level is below the threshold, concluding that the corresponding bit in the overhead bit stream is a logic "zero".

26. A method as claimed in claim 22, wherein the step of detecting comprises:
for each wrapper symbol interval in each located wrapper segment, measuring an average signal level of the low-bandwidth electrical signal during that wrapper symbol interval;
if the measured average signal level is above a first threshold, concluding that the corresponding bit in the overhead bit stream is a logic "one" and if the measured

average signal level is below a second threshold less than the first threshold, concluding that the corresponding bit in the overhead bit stream is a logic "zero".

27. A method as claimed in claim 26, wherein the first threshold is located between (1) an expected average signal level of the low-bandwidth electrical signal when the wrapper symbol encodes a logic "one" in the overhead bit stream and (2) the positive three-sigma point of the amplitude distribution of the low-bandwidth electrical signal during the high-speed data stream segments.

28. A method as claimed in claim 26, wherein the second threshold is located between (1) an expected average signal level of the low-bandwidth electrical signal when the wrapper symbol encodes a logic "zero" in the overhead bit stream and (2) the negative three-sigma point of the amplitude distribution of the low-bandwidth electrical signal during the high-speed data stream segments.

29. A method as claimed in claim 22, further comprising:

measuring a peak-to-peak signal level during each wrapper symbol interval in each wrapper segment; and

determining from the measured peak-to-peak signal level an average optical intensity of the composite optical signal.

30. A method as claimed in claim 29, further comprising:

comparing the average optical intensity of the composite optical signal to a desired value; and

controlling, as a function of the result of the comparison, the optical intensity of the composite optical signal in a feedback loop.

31. A method as claimed in claim 22, wherein each wrapper symbol is characterized by at least one intermediate signal level transition.

32. A system for extracting an overhead bit stream from an optical signal consisting of segments of a high-speed data stream alternating with segments of a digital wrapper, each digital wrapper segment containing a plurality of wrapper symbols each of which has an average signal level indicative of the logical value of a bit in the overhead bit stream, comprising:

a receiver for converting the composite optical signal into an electrical signal having an electrical bandwidth that is substantially less than the bandwidth of the high-speed data stream;

a wrapper segment identifier connected to the receiver, for locating the position of each wrapper segment in the low-bandwidth electrical signal; and

a detector connected to the wrapper segment identifier, for detecting individual bits of the overhead bit stream from the average level of the low-bandwidth electrical signal during the located wrapper segments.

33. A system as claimed in claim 32, wherein the receiver has a bandwidth which is significantly less than the bit rate of the high-speed data stream.

34. A system as claimed in claim 33, further comprising a low-bandwidth filter connected to the output of the receiver, for providing an estimate of a d.c. level of the electrical signal.

35. A system as claimed in claim 34, wherein the bandwidth of the low-bandwidth filter is less than the rate of the detected wrapper symbols.

36. A system for extracting an overhead bit stream from an optical signal consisting of segments of a high-speed data stream alternating with segments of a digital wrapper, each digital wrapper segment containing a plurality of wrapper symbols each of which has an average signal level indicative of the logical value of a bit in the overhead bit stream, comprising:

means for converting the composite optical signal into an electrical signal having an electrical bandwidth that is substantially less than the bandwidth of the high-speed data stream;

means for locating the position of each wrapper segment in the low-bandwidth electrical signal; and

means for detecting individual bits of the overhead bit stream from the average level of the low-bandwidth electrical signal during the located wrapper segments.

37. A system as claimed in claim 36, wherein the bandwidth of the detecting means is significantly less than the bit rate of the high-speed data stream.

38. A system for extracting a plurality of overhead bit streams from a respective plurality of single-carrier optical signals forming part of a WDM optical signal, each single-carrier optical signal consisting of segments of a high-speed data stream alternating with segments of a digital wrapper, each digital wrapper segment containing a plurality of wrapper symbols each of which has an average signal level indicative of the logical value of a bit in the corresponding overhead bit stream, the system comprising:

an optical tap coupler for coupling a fraction of the optical power of the WDM signal;

a front end connected to the coupler, for separating the WDM signal into the plurality of single-carrier optical signals;

a plurality of receivers connected to the front end, for converting each single-carrier optical signal into a respective electrical signal having a bandwidth that is substantially less than the bandwidth of the corresponding high-speed data stream;

a plurality of wrapper segment identifiers connected to the plurality of receivers, for locating the position of wrapper segments in each low-bandwidth electrical signal; and

a plurality of detectors connected to the plurality of wrapper segment identifiers, for detecting individual bits of the overhead bit streams from the average level of the corresponding low-bandwidth electrical signal during the located wrapper segments.

39. A method of generating a composite communications signal from a payload bit stream and an overhead bit stream, comprising the steps of:

transforming the payload bit stream into a gapped bit stream comprising recurrent gaps; and

transforming the overhead bit stream into a series of bursts which fit into respective ones of the gaps of the gapped bit stream;

wherein the second transforming step includes mapping each overhead bit into a wrapper symbol which is represented by either a first signal level transition pattern or a second signal level transition pattern depending on the logical value of the overhead bit; and

wherein the first and second signal level transition patterns each have a distinct average signal level and are each characterized by at least one signal level transition.

40. A method as claimed in claim 39, wherein each overhead bit is mapped to N wrapper bits and wherein N is selected as a function of the bit rate of the payload bit stream and of the bit rate of the overhead bit stream in order to produce wrapper symbols at a rate which is substantially constant irrespective of the bit rate of the payload bit stream.

41. A method as claimed in claim 40, wherein the first and second signal level transition patterns each comprise a plurality of signal level transitions.

42. A method as claimed in claim 41, wherein the signal level transitions in each of the signal level transition patterns occur sufficiently often to satisfy network synchronization constraints.

43. A method as claimed in claim 39, further comprising:

applying forward error correction module to the payload bit stream prior to transforming it into the gapped bit stream.

44. A system for generating a composite communications signal from a payload bit stream and an overhead bit stream, comprising:

a clock source for producing a gapped payload clock signal and a bursty wrapper clock signal;

a payload buffer connected to the clock source, said payload buffer receiving the payload bit stream at a constant rate and being read from at the rate of the gapped payload

clock signal, whereby to produce a gapped bit stream comprising recurrent gaps; and

a wrapper symbol coder, for mapping each overhead bit into a wrapper symbol which is represented by either a first signal level transition pattern or a second signal level transition pattern depending on the logical value of the overhead bit and wherein the first and second signal level transition patterns each have a distinct average signal level and are each characterized by at least one signal level transition;

a wrapper buffer connected to the clock source and to the wrapper symbol coder, said wrapper buffer receiving the wrapper symbols at a constant rate and being read from at the rate of the bursty wrapper clock signal, thereby to produce a series of wrapper bursts; and

an interleaver connected to the payload buffer and to the wrapper buffer, for inserting the wrapper bursts at the output of the wrapper buffer into respective gaps in the gapped bit stream at the output of the payload buffer.

45. A method as claimed in claim 44, wherein each overhead bit is mapped to N wrapper bits and wherein N is selected as a function of the bit rate of the payload bit stream and of the bit rate of the overhead bit stream in order to produce wrapper symbols at a rate which is substantially constant irrespective of the bit rate of the payload bit stream.

46. A method as claimed in claim 45, wherein the first and second signal level transition patterns each comprise a plurality of signal level transitions.

47. A method as claimed in claim 46, wherein the signal level transitions in each of the signal level transition

patterns occur sufficiently often to satisfy network synchronization constraints.

48. A method as claimed in claim 44, further comprising: a forward error correction module connected at the input of the payload buffer.

49. A system for generating a composite communications signal from a payload bit stream and an overhead bit stream, comprising:

means for transforming the payload bit stream into a gapped bit stream comprising recurrent gaps; and

means for transforming the overhead bit stream into a series of bursts which fit into respective ones of the gaps of the gapped bit stream;

wherein the second transforming step includes mapping each overhead bit into a wrapper symbol which is represented by either a first signal level transition pattern or a second signal level transition pattern depending on the logical value of the overhead bit; and

wherein the first and second signal level transition patterns each have a distinct average signal level and are each characterized by at least one signal level transition.

50. A method as claimed in claim 49, wherein each overhead bit is mapped to N wrapper bits, wherein N is selected as a function of the bit rate of the payload bit stream and of the bit rate of the overhead bit stream in order to produce wrapper symbols at a rate which is substantially constant irrespective of the bit rate of the payload bit stream.

51. A method as claimed in claim 50, wherein the first and second signal level transition patterns each comprise a plurality of signal level transitions.

52. A method as claimed in claim 51, wherein the signal level transitions in each of the signal level transition patterns occur sufficiently often to satisfy network synchronization constraints.

53. A method as claimed in claim 49, further comprising:

means for applying forward error correction module to the payload bit stream prior to transforming it into the gapped bit stream.

54. A wrapper symbol coder for mapping each of a plurality of overhead bits into a wrapper symbol, the coder being operable to produce either a first signal level transition pattern or a second signal level transition pattern depending on the logical value of each overhead bit, wherein the first and second signal level transition patterns are each characterized by having a distinct average signal level and are each further characterized by at least one signal level transition.